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A

SIMPLE AND EXPEDITIOUS WAY

OF

ESTIMATING THE VALUE OF

MILK

AS AN ARTICLE OF FOOD.

BY JOHN HORSLEY, F.C.S.,

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THIRD EDITION.

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THE VALUE OF MILK

AS AN

ARTICLE OF FOOD.

MILK being one of the necessaries of life, its value in respect of the amount of Butter and its other constituents becomes of great importance to society, more particularly as entire or pure Milk is required for the support of Children and Invalids.

For a long time methods have been devised for estimating it—such as Hydrometers, Lactometers, &c.—which are all more or less worthless; and, indeed, the artfulness of some knowing persons has gone so far as even to adapt them to their own advantage, so that those who use them are deceived in their reliability, and the public in consequence have become powerless against such fraud.

Having given the subject many years consideration, it appears that the only way of meeting it is by resting its value on the amount of Cream, or rather Butter, it yields when properly treated, discarding all other methods as absolutely fallacious.

There may be two classes of offenders concerned, viz., the Milk producer and the retailer. It has been satisfactorily proved, by me, that fresh Milk will throw up the bulk (9-10ths) of its Cream in from two to three hours, and very little afterwards; so that if Cows be milked, say at six in the morning, and the Milk is not delivered before eight or nine to the retailer, a good part of the Cream may have been skimmed off (for there are generally three trials), and even after that it is subjected to further treatment on the part of the retailer, that by the time it is vended little or no Cream is left.

I may even go further, and state, as a matter of fact, that afternoon's milk is always the *richest*, and advantage is taken of it by some persons to skim off the Cream, and mix the residuary liquor with next morning's milk. Besides serving a useful purpose in the animal economy, the retention of the Cream helps *to preserve* the other constituents of the Milk from undergoing fermentation, so that its abstraction is a *double* injury, not understood by those who commit it. Cream is worth 2*s.* 8*d.* per quart, but the skim only a 1*d.* or so; the Milk trade is therefore evidently in a very unsatisfactory state, and when water is added, it amounts to a kind of infamy, which cannot be too much reprehended, and is deserving of the highest punishment and exposure.

The Method of Testing.—A table-spoonful or 250 grains of Milk are first poured into the glass tube A, which is 11 inches long and $\frac{3}{4}$ in diameter, and graduated up to 10 inches, each line from 0 to 20 being equal to so much per cent. A similar bulk, 4½ fluid drachms of Methylated Ether (s.g. .730) is next poured in ; the tube being taken in the hand, with the thumb *closely pressed* upon it, the contents are briskly agitated for not less than *four or five minutes*, by which operation the Milk is broken up, and deprived of its fat, or Butter ; a like measure of Methylated Spirits of Wine (60. o.p,) is next added, and the whole well shaken up for at least five minutes more, when, on placing it in the stand B, the oily, or fatty (Buttery) matter will *rise to the surface* almost instantly, and can be easily read off, without any heat being used. Every line being equal to 4.15 grains of solid Butter, as proved by experiment.

One thousand grains of Milk, yielding 10 per cent. of Cream, will therefore show eight lines of Butter oil (1-5th less in bulk), equal to as follows:—

Two lines Butter Oil, from 250
grains of Milk, weigh......... 8. 3 grains.
2
5)16. 6
3.32 per cent.

which is the natural quantity from Milk of 10 per cent. of Cream, so that ten lines of Cream would represent 33 grains of Butter, In this experiment the Milk is separated into three parts, viz.,—the Butter which floats on the top; the clear liquor containing the Milk Salts; and the white flocculent matter (Casein) which is precipitated

If it is desired to analyse it further—

The Butter oil is to be carefully drawn up into a small minim glass syringe, and the *last* drop of aqueous fluid projected back again, leaving only the Butter oil in the syringe, which, by depressing the piston, can be collected in a small weighed platinum or gold capsule, warmed over the water bath for a minute or two, and the gross weight taken, the tare of the vessel being noted, the actual weight of the solid Butter is easily ascertained.

In order to estimate the Casein, Sugar, and Salts, proceed thus: Fit into a funnel a piece of close cambric, and gently decant the clear liquor of the glass tube A, add a little distilled water to the Casein, agitate the tube well, and project the contents on to the filter, well cleaning it out afterwards with more distilled water, aided by a long feather. When all the liquid has passed through, put it by for evaporation to dryness, for estimation of the Milk Sugar and Phosphates, if

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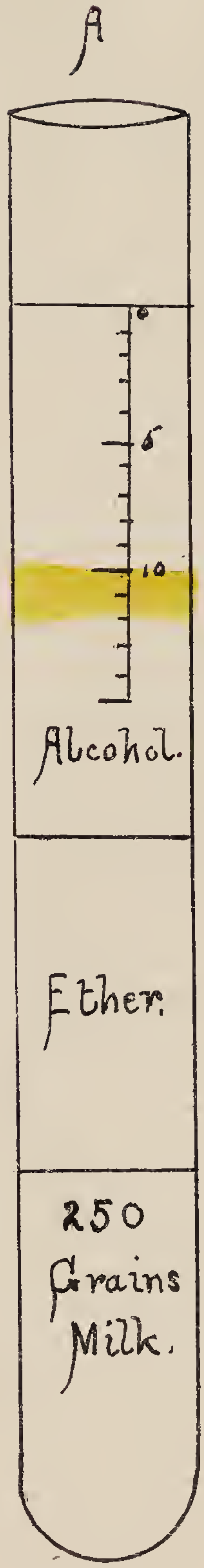
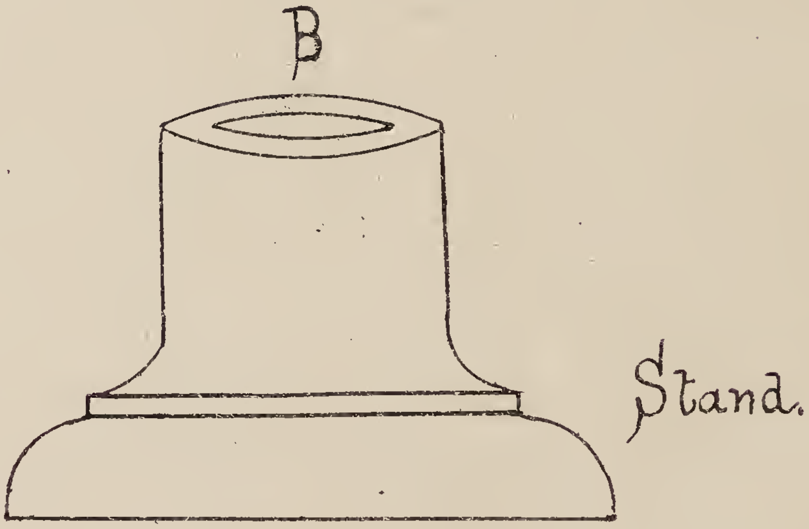


Graduation of Butter Oil from
A Tablespoonful of Milk.



necessary. Then, being provided with a few sheets of stout grey blotting paper, take out the cambric filter, fold in two, and, laying it between the blotting paper, press out, by hand, all moisture. Re-open the cambric, and, placing it on a glass plate, scrape off the Casein, dry it in a dish over a water bath, and take its weight from time to time, till it becomes constant.

Having evaporated the clear liquor containing the Sugar and Salts to perfect dryness over the water bath, the following would be the result of the analysis :—

Fresh Milk density	1.030	
Cream	10 per cent.	
Butter, or Fat	3.32	Solid Matter,
Casein, or Cheesy Matter	4.12	
Sugar and Salts	5.00	
	12.44 grs. per cent.	

plus 87.56 inherent or natural water lost in the process.

Considering this as the *average* composition of genuine Milk, any departure from or reduction of this amount of Milk solids will indicate the *addition* of so much water, particularly if little or no Butter exists, which is the *principal point* in question ;— thus : supposing 1-4th or 25 per cent of water had been used, the amount of solids would be reduced

3.11 grains, making them 9.33, which, deducted from 100 of Milk, would show 90.67 per cent of water, instead of 87,56 as before stated. On the other hand, if there be *more Casein* than the natural quantity, and little or no Butter, it would follow that skim had been used instead of water, which would be *equally an adulteration*, as decided by the Glasgow magistrates.

It would be as well to be provided with two of the graduated glass tubes, with their stands, one to be used for estimating the amount of Cream, by pouring in Milk up to 0, and letting it stand for several hours, and another for treating 250 grains or 4½ fluid drachms measure of Milk with, first, Methylated Ether, and then Alcohol, as described, so as to estimate the lines of Butter oil from which its weight can be ascertained.

These two experiments (the Cream and the Butter) may, in most cases, suffice to show the actual value of the Milk, the rest, or analytical part, may not be cared for by some persons.

But, I would suggest however, in justise to yourself, as well as the Milk dealer, the supply of Milk should always be obtained as *soon as possible* after the known hours of delivery, if you want it genuine and unskimmed.

Methylated Ether and Methylated Alcohol are cheaper than the purer kinds, and answer quite as well for Milk experiments.

By way of recapitulation, if preferred, in the place of using the thumb to cover the mouth of the glass tube during the necessary agitation, a nicely fitting cork will answer as well, using equal quantities of Milk and Methylated Ether first, then holding the tube in the right hand, with your watch in the other, *patiently* agitating it for full five minutes, afterwards pouring in the Methylated Alcohol up to only figure 10, so as to allow of sufficient room for motion, giving five minutes more for the rest or final operation of agitation, when the Butter oil will rise to the surface on a few minutes repose after placing in the stand.

Sometimes, according to the richness of the Milk, as much as four or five lines of clear Butter oil may be obtained. The *whole success*, however, (for there is no ambiguity or fallacy about it, provided the Milk is of good quality,) depends on the *amount of agitation* used by the operator, which is analogous to that of churning.

If the film of Butter oil should grow thick from cold the application of the warm hand for a few minutes, or perhaps a piece of spongio-piline wrung out in hot water, to the upper part, will render it perfectly bright for drawing off and estimating the actual weight of Butter from the table-spoonful of

Milk used;—then, as two table-spoonsful are equal to one ounce, multiplying that by 20, we can tell how much Butter a pint of Milk will yield.

With regard to the detection of adulteration with water in cases where the evaporation of 250 grains of Milk to dryness, to ascertain the deficiency of Solids from the *natural* quantity (12 grains per cent.) is inconvenient, recourse must be had to the use of a small glass spindle, graduated in fives down to 50, by which the density of the Skim can be easily taken, thus—say the Cream, having been taken off by means of a separatory vessel, the residuary liquor will show the following variations in density:—

Specific Gravity of New Milk at 60° Farh. compared with Water.	Spec. Grav. of Skimmed at 60° Farh.	Per cent. Water used.
1,030 pure	1,031 pure	0
1,027	1,028	10
1,024	1,025	20
1,021	1,022	30
1,018	1,019	40
1,015	1,016	50

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HORSLEY'S

METHOD OF ESTIMATION

AND

ANALYSIS OF MILK.

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